Appl. No. 10/648,687

<u>Amendments to the Specification</u>

Please replace line 12 on page 5 with the amended line:
Medicine, including scintimammography <u>and nuclear cardiology</u>, and x-ray radiography, specifically, x-ray

Please replace line 21 on page 9 with the amended line:
to, CdZnTe, CdTe, GaAs, Ge, Si, SiC, Se, ~~PbI2~~ <u>PbI_2</u>, TlBr or ~~HgI2~~ <u>HgI_2</u>. The detector format is

Please replace line 23 on page 9 with the amended line:
D semiconductor arrays coupled to ~~scintillators~~ <u>scintillator arrays</u>. For example, thin, linear semiconductor

Please replace lines 1-2 on page 10 with the amended lines:
arrays of avalanche photodiodes coupled to ~~scintillators~~ <u>scintillator arrays</u> can be used as radiation detectors. This approach can be extended to include ~~scintillators~~ <u>scintillator arrays</u> coupled to integrated

Please replace lines 19-20 on page 10 with the amended lines:
Semiconductor detector materials such as Si, Ge, GaAs, Se, CdTe, CdZnTe, TlBr, ~~HgI2~~ <u>HgI_2</u>, ~~PbI2~~ <u>PbI_2,</u> etc. are candidates for edge-on imaging applications in nuclear medicine (SPECT,

Please replace line 9 on page 12 with the amended line:
Information. An ~~enhanced version~~ <u>additional enhancement</u> provides interaction height information. (Other 2-D

Please add the following new paragraph after the paragraph ending on line 17 on page 12:

Semiconductors detectors may not be the most cost-effective solution for all imaging applications in nuclear medicine (or applications such as remediation of radioactive contaminates, etc.). Scintillation phosphors may still offer opportunities when fast readout times are required or high atomic numbers and densities are desired. Depth-of-interaction information and interaction height information (sub-aperture resolution) can be acquired using 1-D and 2-D edge-on scintillator arrays by adding a dual-readout (photodetector readout in this case) capability as was done with 1-D and 2-D edge-on semiconductor arrays.

Please replace lines 13-14 on page 18 with the amended lines:
format, can be utilized. This design may also be implemented by using ~~semiconductor detectors~~ photodetector arrays coupled to ~~scintillators~~ scintillator arrays as well as other types of detectors. These detectors are

Please replace lines 8-9 on page 36 with the amended lines:
energy photon imager. In this case the back-end edge-on gamma camera (or back-end edge-on PET camera if appropriately designed) detects high-energy gamma rays. The front-end 2-D face-on detector in

Please replace lines 20-22 on page 36 with the amended lines:
further modified to include additional layers (a stack) of face-on detectors permitting multiple Compton scatter events to be tracked. This multi-layer (stacked) edge-on Compton camera design can be exploited in edge-on SPECT and edge-on PET cameras by stacking edge-on detectors in order to provide even

Please replace line 19 on page 38 with the amended line:
~~HgI2, PbI2~~ HgI_2, PbI_2, etc. are candidates for edge-on imaging applications in nuclear medicine

Please add the following new paragraph after the paragraph ending on line 15 on page 40:

The benefits of sub-aperture resolution (increased spatial resolution, signal loss compensation, fewer readout detectors, increased detector volume) that are possible with edge-on semiconductor detectors can also be attained using scintillator arrays in an edge-on detector geometry. The 1-D edge-on scintillator array design described by Nelson, U.S. Pat. No. 4,560,882, used a 1-D photodetector readout array orientated parallel to and coupled to the length of the scintillator pipes (array elements). Ionizing radiation was incident on an end face of the pipes. The end face of a scintillator pipe thus defined the 1-D linear resolution and the aperture height. The end face of a segmented scintillator pipe (now a column of array elements) also defined the 1-D linear resolution and aperture height for the 2-D edge-on scintillator array coupled to a 2-D photodetector readout array. Coupling a second 2-D photodetector readout array to the opposite side of the 2-D, edge-on scintillator array permits an analysis of the relative signal strength measured at both ends of individual scintillator elements in the array. By calibrating the relative signal strength versus interaction location in the direction of the aperture height (interaction height) sub-aperture resolution can be achieved with a dual-readout, edge-on scintillator array detector. (With sufficiently fast readout detectors time-of-flight measurements could be used to determine the interaction location.) A 2-D, edge-on scintillator array detector can now function as a 3-D, edge-on scintillator array detector. Using the dual-readout arrangement concept it is straightforward to provide a 1-D, edge-on scintillator

array detector with 2-D, edge-on scintillator array detector capabilities. This capability can be used to extend the aperture height of the scintillator elements with the understanding that optical signal losses will increase with increasing aperture height. Of the various methods that can be used to assemble 1-D and 2-D scintillator arrays, efficient manufacturing techniques to build structured 1-D and 2-D scintillator arrays for gamma and x-ray detection are described in Nelson, U.S. Pat. No. 5,258,145, which is incorporated by reference for all it discloses and describes. Customization can be achieved by modifying (encoding) the distribution of scintillator signal that reaches both ends. This can be achieved by modifying the side walls of the scintillator crystals using techniques such as ion implantation, etching, or painting patterns on the side wall surfaces that redirects or attenuates at least a fraction of the scintillation signal due to a photon interaction. Calibration will be needed. For detector geometries in which an area detector is used the photodetector array is likely to be a relatively thin, low-noise photodetector arrays such as a photodiode array, an avalanche photodiode array, a drift detector array, a HgI2 array, etc. so that dead space can be minimized within a detector module. For cases such as a PET ring detector a long photoemissive detector such as 2-D PMT can be used for readout if it is oriented perpendicular to the plane of the detector ring (assuming a PET detector ring with a useful axial thickness limited to the aperture height of an edge-on detector module). Of course it is possible to mix photoemissive detectors with other types of photodetectors if the detector geometry permits. The PET ring might use PMTs on one side and a photodiode or avalanche photodiode array on the opposite side. With this arrangement two detector rings could be merged with the photodiode sides facing each other for minimal dead space. Thus, sub-aperture resolution can be attained for 1-D and 2-D edge-on scintillator detectors and can be used for SPECT, PET, and Compton gamma cameras (as well as neutron and particle detectors).